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Lights on - Raman approach for monitoring cells in Pharma- and Toxicology

Schütze, K.[1], Kremling, H.[1], Vaes, B[2], Lorenz, A[3], Maschmeyer, I[3]

[1]CellTool GmbH, Bernried, Germany
[2]Regenesys, Bio-Incubator Leuven, Belgium
[3]TissUse GmbH, Berlin, Germany

Introduction

Raman spectroscopy (RS) is a well-known and highly specific method extensively used in physics, chemistry and pharmacology. Here we provide evidence that RS can not only help to analyze physical and chemical compounds but is also a reliable and easy-to-use tool to monitor cellular processes.

Objectives

Our focus was to develop a method which allows label-free and non-invasive analysis of cellular processes on single cell level. RS is predestinated for this task as it enables monitoring of cells with pure light alone, keeping them alive and unharmed during analysis. With this, RS provides a universal tool to answer a large variety of biomedical questions, providing scientists and physicians whole new insights into their cellular models.

Materials & methods

In a first experiment, the influence of different culture conditions on bone marrow stem cells was analyzed. To do so, cells were grown in different media for several days, fixed in 3% PFA, blinded and analyzed using RS. In a second approach, the effects of troglitazone and retinoic acid on a tissue culture model consisting of liver and skin organ equivalents was monitored. For this, Raman spectra of the cell supernatants were taken to detect cell-secreted insulin.

Results

Using bone marrow stem cells grown in different culture media, RS was able to detect variances between the differently cultured samples and group them into several subgroups although samples were blinded. In case of tissue culture models, it was possible to detect Raman spectra of cell-secreted insulin within the supernatants. In addition, it was possible to discriminate between control, troglitazone and retinoic acid treated samples due to different insulin concentration.

Conclusion

Raman spectroscopy allows to see biological samples in a whole new light, providing highly specific information while keeping cells intact for further analysis or use in patient specific care. It works under physiological conditions and without the necessity of labelling agents or specific markers. In addition, only a few cells are required to monitor e.g. cell reaction on drugs or toxins. Thus, RS has great potential to supplement traditional approaches in the field of pharma- and toxicology.

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